

WHAT IS CLAIMED IS:

- 1 1. A method of negotiating point-to-point protocol (PPP), the method
2 comprising:
3 receiving a first configuration request packet at a first network element for a
4 network connection from a second network element;
5 responding with a first packet; and
6 if a first response to said first packet is expected by said first network element,
7 determining expected contents of said first response, and
8 if said expected contents of said first response to said first packet
9 require a response,
10 responding with a second packet before receiving said first
11 response.
- 1 2. The method of claim 1, further comprising:
2 sending a second configuration packet to said second network element.
- 1 3. The method of claim 1, further comprising:
2 if said first configuration request packet includes at least one unsupported
3 option,
4 responding with a configuration reject packet.
- 1 4. The method of claim 3, further comprising:
2 if said first configuration request packet includes at least one supported option
3 having at least one unsupported value,
4 responding with at least one configuration-NAK packet for said
5 supported option having at least one unsupported value.
- 1 5. The method of claim 4, wherein said configuration-NAK packet
2 includes at least one suggested supported value for said supported option having at
3 least one unsupported value.

1 6. The method of claim 4, further comprising:
2 responding with a first configuration-ACK packet having said supported
3 option with said suggested supported value before receiving a response
4 to said configuration-NAK packet.

1 7. The method of claim 6, further comprising:
2 starting a re-send timer.

1 8. The method of claim 7, wherein a value of said re-send timer is
2 dynamically determined according to a network traffic condition.

1 9. The method of claim 7, further comprising:
2 setting a state of said network connection to 'ACK-sent' after sending said
3 first configuration-ACK packet.

1 10. The method of claim 7, further comprising:
2 setting said state of said network connection to 'open' after sending said first
3 configuration-ACK packet.

1 11. The method of claim 8, further comprising:
2 if said re-send timer expires before a response to said second configuration
3 request packet is received,
4 re-sending said first configuration-ACK packet,
5 restarting said re-send timer, and
6 repeating said steps of re-sending and restarting until said response to
7 said second configuration request packet is received.

1 12. The method of claim 11, further comprising:
2 if said response to said second configuration request packet is received,
3 analyzing said response to said second configuration request packet.

1 13. The method of claim 12, further comprising:
 2 if said response to said second configuration request packet is a second
 3 configuration-ACK packet,
 4 setting said state of said network connection to 'open', and
 5 discarding any further responses.

1 14. The method of claim 12, further comprising:
 2 if said response to said second configuration request packet is not said second
 3 configuration-ACK packet,
 4 resetting said state of said network connection, and
 5 initiating conventional PPP negotiation.

1 15. The method of claim 10, further comprising:
 2 if said re-send timer expires before said response to said second configuration
 3 request packet is received,
 4 re-sending said first configuration-ACK packet,
 5 resetting said state of said network connection to 'ACK-sent',
 6 restarting said re-send timer, and
 7 repeating said steps of re-sending and restarting until said response to
 8 said second configuration request packet is received.

1 16. The method of claim 15, further comprising:
 2 if said response to said second configuration request packet is received,
 3 analyzing said response to said second configuration request packet.

1 17. The method of claim 16, further comprising:
 2 if said response to said second configuration request packet is said second
 3 configuration-ACK packet,
 4 determining said state of said network connection, and
 5 if said state of said network connection is not set to 'open',
 6 setting said state of said network connection to 'open'.

1 18. The method of claim 17, further comprising:
2 discarding any further responses.

1 19. The method of claim 16, further comprising:
2 if said response to said second configuration request packet is not said second
3 configuration-ACK packet,
4 resetting said state of said network connection.

1 20. A network element comprising:
2 means for receiving a first configuration request packet at a first network
3 element for a network connection from a second network element;
4 means for responding with a first packet;
5 means for determining expected contents of said first response if a first
6 response to said first packet is expected by said first network element;
7 and
8 means for responding with a second packet before receiving said first response
9 if said expected contents of said first response to said first packet
10 require a response.

1 21. The network element of claim 20, further comprising:
2 means for sending a second configuration packet to said second network
3 element.

4 22. The network element of claim 20, further comprising:
5 means for responding with a configuration reject packet if said first
6 configuration request packet includes at least one unsupported option.

1 23. The network element of claim 22, further comprising:
2 means for responding with at least one configuration-NAK packet for said
3 supported option having at least one unsupported value if said first
4 configuration request packet includes at least one supported option
5 having at least one unsupported value.

24. The network element of claim 23, wherein said configuration-NAK packet includes at least one suggested supported value for said supported option having at least one unsupported value.

25. The network element of claim 23, further comprising:
means for responding with a first configuration-ACK packet having said supported option with said suggested supported value before receiving a response to said configuration-NAK packet.

26. The network element of claim 25, further comprising:
means for starting a re-send timer.

27. The network element of claim 26, wherein a value of said re-send timer is dynamically determined according to a network traffic condition.

28. The network element of claim 26, further comprising:
means for setting a state of said network connection to 'ACK-sent' after sending said first configuration-ACK packet.

29. The network element of claim 26, further comprising:
means for setting said state of said network connection to 'open' after sending said first configuration-ACK packet.

30. The network element of claim 27, further comprising:
means for re-sending said first configuration-ACK packet if said re-send timer expires before a response to said second configuration request packet is received;
means for restarting said re-send timer if said re-send timer expires before a response to said second configuration request packet is received; and
means for repeating said steps of re-sending and restarting until said response to said second configuration request packet is received if said re-send timer expires before a response to said second configuration request packet is received.

31. The network element of claim 30, further comprising:
means for analyzing said response to said second configuration request packet
if said response to said second configuration request packet is received.

32. The network element of claim 31, further comprising:
means for setting said state of said network connection to 'open' if said
response to said second configuration request packet is a second
configuration-ACK packet; and
means for discarding any further responses if said response to said second
configuration request packet is a second configuration-ACK packet.

33. The network element of claim 31, further comprising:
means for resetting said state of said network connection if said response to
said second configuration request packet is not said second
configuration-ACK packet; and
means for initiating conventional PPP negotiation if said response to said
second configuration request packet is not said second configuration-
ACK packet.

34. The network element of claim 29, further comprising:
means for re-sending said first configuration-ACK packet if said re-send timer
expires before said response to said second configuration request
packet is received;
means for resetting said state of said network connection to 'ACK-sent' if said
re-send timer expires before said response to said second configuration
request packet is received;
means for restarting said re-send timer if said re-send timer expires before said
response to said second configuration request packet is received; and
means for repeating said steps of re-sending and restarting until said response
to said second configuration request packet is received if said re-send
timer expires before said response to said second configuration request
packet is received.

1 35. The network element of claim 34, further comprising:
2 means for analyzing said response to said second configuration request packet
3 if said response to said second configuration request packet is received.

1 36. The network element of claim 35, further comprising:
2 means for determining said state of said network connection if said response to
3 said second configuration request packet is said second configuration-
4 ACK packet; and
5 means for setting said state of said network connection to 'open' if said state
6 of said network connection is not set to 'open'.

1 37. The network element of claim 36, further comprising:
2 means for discarding any further responses.

1 38. The network element of claim 16, further comprising:
2 means for resetting said state of said network connection if said response to
3 said second configuration request packet is not said second
4 configuration-ACK packet.

1 39. A network element comprising:
2 a processor; and
3 a network interface coupled to said processor, wherein said processor is
4 configured to
5 receive a first configuration request packet at a first network element
6 for a network connection from a second network element,
7 respond with a first packet, and
8 if a first response to said first packet is expected by said first network
9 element,
10 determine expected contents of said first response, and
11 if said expected contents of said first response to said first
12 packet require a response,

13 respond with a second packet before receiving said first
14 response.

1 40. The network element of claim 39, wherein said processor is further
2 configured to
3 sending a second configuration packet to said second network element.

4 41. The network element of claim 39, wherein said processor is further
5 configured to
6 respond with a configuration reject packet if said first configuration request
7 packet includes at least one unsupported option.

1 42. The network element of claim 3, wherein said processor is further
2 configured to
3 respond with at least one configuration-NAK packet for said supported option
4 having at least one unsupported value if said first configuration request
5 packet includes at least one supported option having at least one
6 unsupported value.

1 43. The network element of claim 42, wherein said configuration-NAK
2 packet includes at least one suggested supported value for said supported option
3 having at least one unsupported value.

1 44. The network element of claim 42, wherein said processor is further
2 configured to
3 respond with a first configuration-ACK packet having said supported option
4 with said suggested supported value before receiving a response to said
5 configuration-NAK packet.

1 45. The network element of claim 6, wherein said processor is further
2 configured to
3 start a re-send timer.

1 46. The network element of claim 45, wherein a value of said re-send
2 timer is dynamically determined according to a network traffic condition.

1 47. The network element of claim 45, wherein said processor is further
2 configured to
3 set a state of said network connection to 'ACK-sent' after sending said first
4 configuration-ACK packet.

1 48. The network element of claim 45, wherein said processor is further
2 configured to
3 set said state of said network connection to 'open' after sending said first
4 configuration-ACK packet.

1 49. The network element of claim 46, wherein said processor is further
2 configured to
3 re-send said first configuration-ACK packet if said re-send timer expires
4 before a response to said second configuration request packet is
5 received;
6 restart said re-send timer if said re-send timer expires before a response to said
7 second configuration request packet is received; and
8 repeat said steps of re-sending and restarting until said response to said second
9 configuration request packet is received if said re-send timer expires
10 before a response to said second configuration request packet is
11 received.

1 50. The network element of claim 49, wherein said processor is further
2 configured to
3 analyze said response to said second configuration request packet if said
4 response to said second configuration request packet is received.

1 51. The network element of claim 50, wherein said processor is further
2 configured to
3 set said state of said network connection to 'open' if said response to said
4 second configuration request packet is a second configuration-ACK
5 packet; and
6 discard any further responses if said response to said second configuration
7 request packet is a second configuration-ACK packet.

1 52. The network element of claim 50, wherein said processor is further
2 configured to
3 reset said state of said network connection if said response to said second
4 configuration request packet is not said second configuration-ACK
5 packet; and
6 initiate conventional PPP negotiation if said response to said second
7 configuration request packet is not said second configuration-ACK
8 packet.

1 53. The network element of claim 48, wherein said processor is further
2 configured to
3 re-send said first configuration-ACK packet if said re-send timer expires
4 before said response to said second configuration request packet is
5 received;
6 reset said state of said network connection to 'ACK-sent' if said re-send timer
7 expires before said response to said second configuration request
8 packet is received;
9 restart said re-send timer if said re-send timer expires before said response to
10 said second configuration request packet is received; and
11 repeat said steps of re-sending and restarting until said response to said second
12 configuration request packet is received if said re-send timer expires
13 before said response to said second configuration request packet is
14 received.

1 54. The network element of claim 53, wherein said processor is further
2 configured to
3 analyze said response to said second configuration request packet if said
4 response to said second configuration request packet is received.

1 55. The network element of claim 54, wherein said processor is further
2 configured to
3 determine said state of said network connection if said response to said second
4 configuration request packet is said second configuration-ACK packet;
5 and
6 set said state of said network connection to 'open' if said state of said network
7 connection is not set to 'open'.

1 56. The network element of claim 55, wherein said processor is further
2 configured to
3 discard any further responses.

1 57. The network element of claim 54, wherein said processor is further
2 configured to
3 reset said state of said network connection if said response to said second
4 configuration request packet is not said second configuration-ACK
5 packet.

58. A computer program product for negotiating point-to-point protocol (PPP), encoded in computer readable media, said program product comprising a set of instructions executable on a computer system, wherein said set of instructions configured to

- receive a first configuration request packet at a first network element for a network connection from a second network element;
- respond with a first packet; and
- if a first response to said first packet is expected by said first network element, determine expected contents of said first response, and
- if said expected contents of said first response to said first packet require a response,
- respond with a second packet before receiving said first response.

59. The computer program product of claim 58, wherein said set of instructions is further configured to

- send a second configuration packet to said second network element.

60. The computer program product of claim 58, wherein said set of instructions is further configured to

- if said first configuration request packet includes at least one unsupported option,
- respond with a configuration reject packet.

61. The computer program product of claim 60, wherein said set of instructions is further configured to

- if said first configuration request packet includes at least one supported option having at least one unsupported value,
- respond with at least one configuration-NAK packet for said supported option having at least one unsupported value.

62. The computer program product of claim 61, wherein said configuration-NAK packet includes at least one suggested supported value for said supported option having at least one unsupported value.

63. The computer program product of claim 61, wherein said set of instructions is further configured to respond with a first configuration-ACK packet having said supported option with said suggested supported value before receiving a response to said configuration-NAK packet.

64. The computer program product of claim 63, wherein said set of instructions is further configured to start a re-send timer.

65. The computer program product of claim 64, wherein a value of said re-send timer is dynamically determined according to a network traffic condition.

66. The computer program product of claim 64, wherein said set of instructions is further configured to set a state of said network connection to 'ACK-sent' after sending said first configuration-ACK packet.

67. The computer program product of claim 64, wherein said set of instructions is further configured to set said state of said network connection to 'open' after sending said first configuration-ACK packet.

68. The computer program product of claim 65, wherein said set of instructions is further configured to

if said re-send timer expires before a response to said second configuration request packet is received,

re-send said first configuration-ACK packet,

restart said re-send timer, and

repeat said steps of re-sending and restarting until said response to said second configuration request packet is received.

69. The computer program product of claim 68, wherein said set of instructions is further configured to

if said response to said second configuration request packet is received,

analyze said response to said second configuration request packet.

70. The computer program product of claim 69, wherein said set of instructions is further configured to

if said response to said second configuration request packet is a second configuration-ACK packet,

set said state of said network connection to 'open', and

discard any further responses.

71. The computer program product of claim 69, wherein said set of instructions is further configured to

if said response to said second configuration request packet is not said second configuration-ACK packet,

reset said state of said network connection, and

initiate conventional PPP negotiation.

72. The computer program product of claim 67, wherein said set of instructions is further configured to

if said re-send timer expires before said response to said second configuration request packet is received,

re-send said first configuration-ACK packet,

reset said state of said network connection to 'ACK-sent',

restart said re-send timer, and

repeat said steps of re-sending and restarting until said response to said second configuration request packet is received.

73. The computer program product of claim 72, wherein said set of instructions is further configured to

if said response to said second configuration request packet is received,

analyze said response to said second configuration request packet.

74. The computer program product of claim 73, wherein said set of instructions is further configured to

if said response to said second configuration request packet is said second configuration-ACK packet,

determine said state of said network connection, and

if said state of said network connection is not set to 'open',

set said state of said network connection to 'open'.

75. The computer program product of claim 74, wherein said set of instructions is further configured to

discard any further responses.

76. The computer program product of claim 73, wherein said set of instructions is further configured to

if said response to said second configuration request packet is not said second configuration-ACK packet,

reset said state of said network connection.